CENTRAL INTELLIGENCE AGENCY

INFORMATION REPORT

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1. The Putilovo project dealt with an airborne rocket which was designed for use by fighter planes against bomber flights. Technical background information was derived from experience with the R100BS, formerly built in Germany. As is commonly known, the R100BS was equipped with a rocket propulsion part which was intended to increase the velocity increment of the rocket projectile to 420 m./sec. The propelling charge of the R100BS consisted of approximately 21 or 21½ kg. of diglycol tubular powder or, in another variation, diglycol multiple-channel profile powder. The warhead of the German model was made up of a large number of incendiary fragments. The incendiary fragments were supposed to penetrate the fuselage of the plane on detonation of an explosive charge, which was released in the immediate vicinity of a plane by a proximity fuse. In Germany it was realized that such a weapon could only be very effective as a surprise weapon and that, after

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a relatively short period of time, it would be possible to fight the fires, caused in the gas tanks by this ammunition, by means of automatic extinguishers, etc. In Germany it was planned as the next development to replace the incendiary fragments by small steel cylinders which would be filled with a Pyrosatz (pyro composition) giving a tracer-type effect. Then, when the tanks were penetrated, the entire rubberization would be torn apart, and the holes would be no longer self-sealing. Gasoline would drain through these holes, and the multitude of red-hot sparks, following the fragments, would set off the blaze. The next fabrication planned was to be incorporated in mine projectiles which carried the designation MIKI. It never went beyond preliminary planning because at the time it was thought that incendiary fragmentation alone was sufficient.

2. In the USSR the Germans were given the task of further developing and modernizing this project. At first some designs were reconstructed in a routine manner, like the preliminary projects worked on formerly in Germany. These designs had a warhead placed in front of the actual rocket chamber in which a large number [redacted] 25X1 there were 28 to 31) of separate projectiles were incorporated (depending upon the different variations). The cap, which enclosed the single projectiles, was intended to be torn into several pieces by a fuse and a detonation lanyard so that the projectiles could be released. The Soviets did not like this solution. For one thing, the length was so great that they had trouble in mounting this missile under their fighter (interceptor) planes.

3. After several years, during which time the Germans worked on other tasks, it was suddenly decided with great urgency to build a rocket which could accommodate a large number of projectiles. It was supposed to be able to penetrate developed armor plate of a plane up to 8-10 mm. thickness. Experiments in Germany previously had advanced to the point where it could be said that a charge of approximately 400 g. tetramethylene-trinitramine or tetramethylenetrinitramine-trinitrotoluene mixture was sufficient to tear apart the fuselage of a plane, even if it did not penetrate the armor plate. This would then cause the plane to lose its flight ability so that it is forced to crash-land, even though it does not crash on the spot. These facts had been previously theoretically calculated and the data were taken over intact by the Soviets. On the basis of these data, definite requirements were given to the Germans to build such rockets. In Germany the length of the device

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MIKI was approximately 2 m., but the Germans were expected to build a considerably shorter prototype. [redacted] the required data, [redacted] was on the order of about 1500 or 1600 mm. overall length. In the course of a few weeks, about ten or fifteen variations were worked on. Designs were made where it was necessary to increase the diameter because the length was decreased, causing greater velocity decline and a reduction in the range of action. This resulted in the issuance of a requirement to increase the size of the propelling charge and the duration of flight. This in turn resulted in larger caliber dimensions. As previously mentioned, variations existed which featured a cap consisting of several parts. Upon approach of a plane, these cap parts were supposed to flip open and release the mines either by a time fuse or possibly by the optical fuse, previously developed in Germany, which detonated upon approaching a plane. Other possibilities were taken into consideration whereby the mines were ejected toward the front. The Germans completed several theoretical path-of-flight calculations. Along these lines, they tried to construct the swinging action. Frequently it showed that difficulties were to be expected upon discharge of the projectiles from the magazine. During all this designing, it proved to be more favorable to pull a closed cap over the complete rocket part and to use a ring magazine (a magazine in which the single mines are arranged around the actual rocket as an outer ring). Since a larger ogive was necessary for more favorable aerodynamic conditions, there was space available in the tip of the missile into which more mines could be arranged. Then, to balance the center of gravity, it was necessary to place some weight in the front so that the location of the center of gravity became more favorable and stability conditions were improved. There was a rocket chamber for which the Germans maintained that a caliber of 220 mm. was suitable because a large number of tubes was still in stock with this measurement.

DETAILED DESCRIPTION OF SOVIET AIRBORNE ROCKET

4. The magazine was made of a chromium steel which resembled the German chrom-vanadin steel 240, and which had an allowable proof stress of from 60-65 kg. per mm^2. with a strength factor of approximately 85 kg./mm^2. This steel also had another good feature in that it could be welded. It was ideal for such a fabrication. The Germans were able to increase the charge to a 24 kg. maximum by corresponding development

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of the propelling charge with consideration of the maximum possible by a presqueeze or choke (Vorklemmung ratio of burning surface to diameter of free area of diaphragm.) The Germans had previously reached an initial thrust of approximately 4600 kg./sec. with 24 kg. of powder. The specific efficiency of the Soviet powders was somewhat lower than that of German. In Germany they were able to reach a specific thrust of from 200-210 (on special occasions). However, the Soviet powders generally reached values of from 190-195 kg./sec.

5. In the USSR the powders most frequently placed at the disposal of the Germans were a nitroglycerine powder or nitrocellulose powder. The rocket part located in the center had a 200-mm. outside diameter with a total length of approximately 1100 mm. from nose to trailing edge of the tail assembly. The mines were arranged around this chamber in rows of two. The projectile had a caliber of approximately 50 mm. Several variations were worked on--of 48, 52, 55, and even 56 mm.--which left a certain freedom of movement according to the dimensions of the rocket chamber. Sometimes it was necessary to arrange spacer strips around the circumference between one or more of the mines so that they would not get out of place during the flight. Taking into consideration the manufacturing tolerances, it was necessary to provide spaces. With this arrangement, the Germans were able to place 16 mines around the circumference. Two rows of mines were placed around the combustion chamber, forming a ring between the propellant and the outer ring of the magazine, for a total of 32 projectiles. These 32 projectiles were equipped with tail assemblies, which did not protrude much beyond their own circumference. According to the German theoretical calculations, insufficient stabilization was to be expected. However, the projectiles should have flown just about stable, but they would have shown a very slow damping out of the shock waves, which was inevitable at ejection from the magazine. Therefore, the Germans decided to equip these projectiles with a folding tail assembly. The possibility was still kept open, though, for replacing the folding tail assembly by a fixed tail assembly. However, because of aerodynamic effects, it is not known whether it would be possible to dispense with the folding assembly. This would have been more advantageous for manufacture because it would have been cheaper and would have caused less disturbance if additional stabilization had not been necessary. This particular design, however, provided for an explosive charge more or less in the cylindrical part only so that, way back in the rear, there was always free air space mainly to assure sufficient stabilization.

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6. Previous diagrammetric sketches of the configuration with the expected center of gravity were sent out for a wind tunnel test. They were sent to an Institute Zeigiet The location of this Institute was never made known to the Germans. However, tests were made and [redacted] the stability factor was sufficient [redacted] the project could continue as planned. [redacted] If someone asked about this place, the questions were just ignored and the conversation ended. Further questioning was thus discouraged. [redacted] the rockets between 250 and 285 mm. in length, depending upon which type of head was used; with blunt head 250 mm., with ogive approximately 285 mm. total length. [See pages 13 to 17.] It so happens that the folding tail assembly protrudes a little beyond the circumference of the projectile. Therefore the mines were on the same level. [redacted] For example, the even numbers were arranged on the outside and reached all the way to the trailing edge. The adjacent column of projectiles was pushed forward 70 mm. whereby a small sheet-metal cap of about 70-75 mm. length insured the correct spacing. The next even number started with a column which bordered the edge. The tail assemblies thereby did not hinder each other. Naturally, the 70-mm. construction length was lost, but this was the only possible way to accommodate a stable projectile in this type ring magazine. In the front part of the ogive was enough space to allow easy arrangement of six more projectiles. To arrange a seventh mine in the center was impossible because a special ejecting cylinder with its own plunger was incorporated for the ejection process. The rocket was so planned that a cylinder was screwed to the front part of the rocket chamber. The cover plate or cap was provided with a high-temperature inhibitor. Simultaneously with the burning of the rocket charge, an inhibitor composition was ignited which became effective after about 1/10 of the burning period of the rocket and detonated the ejection part. This was very definitely a substitute solution which was only provided because of a special request from the Soviets.

7. The Germans were always fully convinced that universal combat service of such a rocket would be practicable only if the actual battle distance of the fighter plane could be taken into consideration. For the later models, it was necessary to incorporate an adjustable time fuse which at the moment of release would still take into consideration the actual shooting distance between fighter plane and target. This was necessary so that ejection would take place shortly before reaching the target area. For the first phase, the Soviets said they did not want anything like this;

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they only wanted to be sure of a high-temperature inhibited-ejection process to test the function of this thing.

8. The Germans were required to use a high-temperature fuse already on hand, which was rather well designed and constructed. It was not directly ignited by the rocket charge itself. This would have caused detonation especially at extremely low temperatures, and, in the case of a misfire, the ejection process would have started simultaneously. This special fuse which was on hand in the USSR worked in such a way that, due to the gas pressure inside, a small plunger was activated. The plunger struck the fuse cap and the fuse cap on the inside ignited the high-temperature charge. If a misfire happened now, nothing could go wrong. Only the gases from the fuse cap, which were practically harmless, not the rocket chamber gases, could enter the front part of the ogive. This fuse was supposed to have proven its merits previously in other fabrications. This fuse was then incorporated and, joining the fuse, a cylindrical pipe was provided which reached practically to the front of the magazine. On the inside of this cylinder, another tube, held in this position by a shear pin, was inserted without special sealing. An ordinary steel plug was provided at the end of this pipe which provided for tightening of the bell-shaped magazine housing through a half-round-headed screw. The tightening was done in such a manner that the front row and the back row of the individual mine columns were mounted into the space around the combustion chamber. Then the ogive projectiles were put in by means of a mounting aid and held in place by a small rubber band or a paper strip and then the bell was pushed over the assembly. At the front they had a reinforcement ring, so that the projectiles were arrested there. The projectiles in the front part had to be placed at an angle; otherwise, they would have hindered each other because of their folding tail assemblies. Therefore, a larger diameter of 50 mm. was formed. This 50 mm. was given through the ejecting pipe. The projectiles are the same size in front as in the back. In other words, they are interchangeable. The inside ring of the combustion chamber was a pressed deep-drawn sheet-metal ring, which was connected with the chamber cover by spot welding. This ring served for centering purposes while the actual magazine bell contained a bracing ring which in itself insured centering to the previously-mentioned sheet-metal ring and then spotwelded to the chamber. In this manner, good centering was assured. The tail assembly consisted of a deep-drawn sheet-metal body which was closed off at the front by a sheet-metal cover. This sheet-metal cover was pressed over the body. It was welded at the connection at the end of the rocket where it was joined with the combustion chamber. In

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this manner, the whole thing was firmly connected. For a seal, a small groove with a rubber band fitted in was used so that no outside moisture could enter. It was pushed on in mounting and everything was tightened by a screw. [redacted] 25X1 25X1

9. The short mounts were used which, according to German experience, proved much more advantageous where accuracy of hit was a factor. At the front of the mount was a button and, on the back side, two guard studs. The guard studs were mounted even with the rear centering so that necessary stiffness of the magazine housing was insured. As a propelling charge in the rocket, a three-channel powder of prismatic-pressed pieces was used which left small powder rests in the form of a triangular wedge (gusset). Theoretically a large amount of the powder was supposed to have been left over. However, experiments on the test stand proved that these supposed "left-overs" had also burned. It cannot be assumed that, if these powder "left-overs" were not burned and were discharged through the jet nozzle, they would in any way damage the aircraft. It would have been better to avoid these wedges altogether, but they were available in the above form and the Soviets insisted they be used. However, according to former German experience, they had to deal with these powder left-overs quite often. However, the pilot was never really bothered with this problem. The magazine bodies were rolled from 2 mm. sheet metal, with a longitudinal welding seam, and the head was pressed on. It was planned to deep-draw the head later on, but these were technological things about which the Germans did not bother. The stabilizing wings were about 620 mm. [redacted] 25X1 25X1 It could have been somewhat smaller or larger. The Germans always pointed out that, without wind tunnel tests, such things cannot be tied down emphatically. It was then required that aerodynamic calculations be carried out. [redacted] 25X1 25X1

10. The outer form had to be tested in the wind tunnel. Necessary values were reported to the Germans. After they knew what the CA, CM, and CW values were, it was possible to figure the neutral point and possibly find a suitable design which could have possibly carried even more projectiles. There is a possibility that some of the projectiles had been moved toward the rear. However, the center of gravity would have moved quite a bit towards the rear. This question could have only been cleared up through wind tunnel tests. Wind tunnel tests were made with the magazine, 25X1 [redacted] The Germans were told only that the mines were all right.

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11. The Soviets were not quite satisfied with the design as such. The rocket velocity increase caused by the propelling force was to have reached approximately 350 m./sec. with this design. They indeed wanted a performance of 450 m./sec., still better yet, 520 m./sec. This requirement naturally was not easily realized any more with this caliber. The last requirements [redacted] were so adjusted that a greater number of mines should have been incorporated. The Germans worked out several projects where the total number of mines was between 54 and 60 pieces. Here they had larger rocket chambers and, in one case, chambers of 240 mm. With the 240-mm. rocket chambers, the Germans still did not achieve any velocity increase but only the fact that the chambers could accommodate 60 projectiles. The enlargement of the rocket-propelling charge, and the outside diameter of the rocket chamber of 240 mm. made it possible to accommodate more projectiles because of the increased length so that three rows at 18 each made 54 mines in the cylindrical part. Six mines in the ogive made a total number of 60 small projectiles. With all this, the rocket velocity remained in the same range. Because of this, the requirement was handed down to increase performance to reach at least 420 to 450 m./sec. Other designs were worked on which were 260 or 280 mm. [redacted] The principle of the ring magazine remained, however, which has the following advantages: (a) shorter length, meaning easy handling and loading on the plane itself, and (b) trouble-free ejection of the projectiles from the magazine. A rotation of the whole rocket was again done by interference strips during the test period. [redacted]/ In the later model, the entire stabilizing surfaces were aligned to a slant at a small angle of about two-three degrees so that the necessary revolutions were insured. /See page 13./ The theoretical path of flight calculations showed, however, that it was more advantageous to let a component of the impulse become effective in tangential direction. This caused a noticeable rotation directly after release from the plane. Releasing disturbances, occurring from time to time, caused by a swinging of the plane or other disturbances of the rocket, or possibly interference from a nearby rocket, etc., were held to a minimum in this manner. In such a case, it was favorable to have a noticeable rotation immediately upon release. The rotation resulted in a helicoidal path of flight reducing a one-sided disturbance of the rocket to about one-third of the original value. The Germans carried out several ballistic calculations which resulted in the optimal number of rotations.

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12. Releasing disturbances were also taken into consideration, resulting in a favorable opening angle too wide for the projectiles. This means that the rocket would have to get very close to target if the projectiles open with such a wide angle. This caused certain difficulties because small mistakes in distance estimation

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result in sizeable differences in the target area. Thus, bad scatter had to be taken into consideration. The Germans were therefore interested in effecting ejection at a greater distance. At greater distances, they were not dependent upon use of a projectile with ogival fuse. Such an ogival fuse was available but unsuited for the purpose. The blocking of the fuse had to occur through rotation. The Germans were able to use a fuse which was rotation-activated like a normal artillery fuse, and armed by the spin of the shell. This fuse was given a lighter weight-spring suspension to open at a small number of rotations. The rotations of the mines were obtained through interlocking of the folding tail assembly of the projectile itself because the wings were slightly slanted. The necessary number of rotations was obtained without any great difficulty and activation of the fuse was assured during the course of flight. Such a fuse had a liquidation, i.e., a disintegrating, arrangement, so that the projectiles would not cause greater harm on the ground than to the enemy planes. The liquidator was necessary. The Germans were told to write the technical specifications for it. [redacted] 25X1 25X1

The Germans were told, however, not to use such a fuse for the first experiments but to use Fuse 66 (fan igniter) [redacted] which they incorporated into the project Molniya. Basically this was possible. However, the blunt shape caused such a quick velocity decrease of the projectiles that an ineffectiveness of the projectile in the battle range appeared imminent, because the necessary final speed was not sufficient to penetrate the fuselage of the plane. It was not necessary to penetrate the armored-plate behind the fuselage because the ignition delay was adjusted to approximately 20 cm. The detonation occurred before the armor plate was reached and caused considerable damage to the fuselage of the plane, so much so that further flight was impossible.

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13. The action distance of 800-1000 m., for which this equipment was originally designed, could still be obtained. The Germans were not forced to open the magazine, which was not immediately emptied after combustion of the rocket-propelling charge, but a minimum distance of 0.1 sec. (sic) was covered before ejection was possible. However, in many instances, the distance had to be increased somewhat so that the projectile was close enough to the target. Here it opened up and from then on the projectiles resumed their own path of flight.

14. The mines themselves are without a propellent. On different occasions, the Soviets required the Germans to use rocket projectiles there, too. However, the Germans did not spend much time on this project because (1) they lacked the time for it, and (2) because such a project did not look promising to them. Difficulties were to be expected in igniting the small projectiles with certainty. It was far more advantageous in this

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case to keep the large projectile with its greater ballistic coefficient and let it continue its flight and to release the individual easily-manufactured projectiles close to the target. Upon Soviet request, variations were worked on, which made it possible to tighten from the back each of the 16 columns separately with a special tightening device so that the projectiles were fitted in rattle-free. In my opinion, this was an unjustified additional expenditure. It was easier to adjust them by cardboard enclosures at the time of installation. It was cheaper and did not require as much additional weight. However, it was desired and I delivered one magazine with an adjusting device and additional weight. As previously mentioned, several variations were worked out.

HIGH PRIORITY PLACED ON PROJECT BY SOVIETS

15. Apparently much importance was placed upon the entire project. This was also shown by the fact that, on several occasions, active military personnel conferred with the Germans. This proved conclusively that active groups were counting on such a missile. [redacted] 25X1
25X1 [redacted] this design in particular presents an extremely effective weapon in the fight against larger bomber squadrons or groups of several hundred planes. The reason that a bomber group is such a likely target is that, as a group, it is limited in its maneuverability. It is almost impossible to maneuver in it and one is forced to more or less maintain a given course. However, with such a glide missile, there are no correction possibilities during the flight, and the target can only be reached if this target cannot turn about.

16. The Soviets said very often what is the use, if today a single very fast plane appears carrying an atom bomb? What can this missile do in such a case? The Germans said it was best then to remain on the ground, that it was silly to shoot against such a plane, as it could not be hit anyway. [redacted] 25X1
[redacted] 25X1

17. It is also to be mentioned here that the Germans designed rocket-propelling parts with all ballistic calculations about flight characteristics and fabricated them, too. The Germans provided a tuyere plate in the place of a central jet with a nozzle scroll consisting of several single nozzles. These nozzle scrolls had an advantage inasmuch as they made it possible to dispense with the tangential nozzles. The Germans could provide these nozzles with a small slanting angle, seen in axial direction, and produced a tangential component with this. Several variations were intended, one of which had the mouth of the venturi cut off at a certain angle. The jet axis, however, remained completely parallel to the main axis of the rocket; only the mouth was cut at an

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angle to obtain a small spinning effect. The Germans are not sure how close this thing came up to the expectations. [redacted] 25X1

25X1 18. [redacted] 25X1 The projectiles were provided with a detonator. Single parts, of course, could not be seen, but it was possible to see the rocket fired, and suddenly, at a distance from the rocket, a number of single bursting points were noticed. [redacted] 25X1

25X1 [redacted] many variations had been built. Possibly just as many variations were built as were designed. Some of them had approximately 24 bursting points; other types were present with about 50 bursts, [redacted] 25X1 some had as many as 70 or 80 bursts. There were so many [redacted] 25X1 25X1

25X1 [redacted] distinct differences could be noted, because the mines apparently continued their flight on a clean pitch circle and were not distributed over a large area after a ragged flight. There were pronounced rings over which these bursting points were distributed with rather equal distances. It was also noted that there were designs with different scrolls in each. Here, for example, were two scrolls, because the ogival mines run on a small cone slope whereas the ring projectiles were in the outside scroll. The Germans also had designs which carried another intermediate stage to adjust them as much as possible to the ogive [redacted] 25X1 such figures in the sky where three scrolls were one in the other. Apparently these projects were propelled by several systems because, if the Soviets decide to build a large number of one piece of equipment, they consider it quite urgent. For previous developments, great sums of money were seldom invested. Usually pieces numbered from 2-5 because they wanted to test the overall function only. For subsequent experiments, the Soviets may have ordered 15-20 pieces; but, whenever they decided to invest great sums of money, it was deemed the good assurance for materialization must have existed. On the other hand, these things were started right away with rather large expenditures.

19. Regarding the ejection process, the ejection cylinder located in the head in the ogive, with the pipe plunger contained therein, only accommodated a small ejection charge of approximately 30 g. black powder (composition unknown). This ejection charge with a larger pressure in the neighborhood of 100 $kg./cm^2$ [redacted] 25X1

25X1 [redacted] produced such a pressure that the thrust was strong enough to shear through the shear pin at the top (indicated on the drawing). This pressure from the plunger was then transferred to the entire housing, the housing accelerated towards the front; while, through the same

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impulse, the inner rocket part, together with stabilizer, was retarded. The ejection process for the projectiles, accommodated in the ring magazine, was completely trouble-free. They could not leave their positions until the housing was pushed off. The rotation present permitted the mines to emerge radially without any greater releasing disturbances and sent them on their way after the tail assembly wings opened up. Special aerodynamic help to open the wings was not necessary. The rocket rotation had previously been transferred to the mine bodies. This rotation was sufficient to open up the tail assembly wings in radial direction. Once they opened up radially, the impact pressure on the interference strips was sufficient to move them to their final position, so that the projectiles could continue their flight with the wings angled in an arrow-shape setting. The projectiles in the front part were so constructed that, after ejection, they possessed the tendency through their inertia to remain relatively in place. The rocket chamber was accelerated forward so that the specifically lighter-weight housing was forced several meters ahead of the actual projectile after a short period of time. The Germans conducted computations of how great this speed had to be completely to offset the damping by velocity pressure and to expand several meters with safety, the reason being that the projectiles lying in between could be ejected without running the danger of being pulled back into the housing while the housing was being retarded by the air pressure. All these things had been theoretically considered. The Germans were not told how they worked out in reality, but what they saw in the sky was not unfavorable. [See page 16.] First is the course of the plane; then point of release, from the control stick of the plane. Next is the period of combustion of approximately 0.85 seconds. The heavier-weight types naturally have a somewhat longer period of combustion, of about 1.2 seconds, and some even with longer combustion periods. After the end of the combustion period, after about 0.1 seconds, the pyro-technical fuse started its function. This was the shortest period of delay that is practical and possible. In reality, it was desirable for this period of time between the end of combustion of the rocket and ejection of the mines to be several seconds, so that ejection process could have been accomplished shortly before reaching the actual target point. If the target point was passed, a few seconds thereafter, the detonator would automatically discharge so that no loaded missiles could reach the ground.

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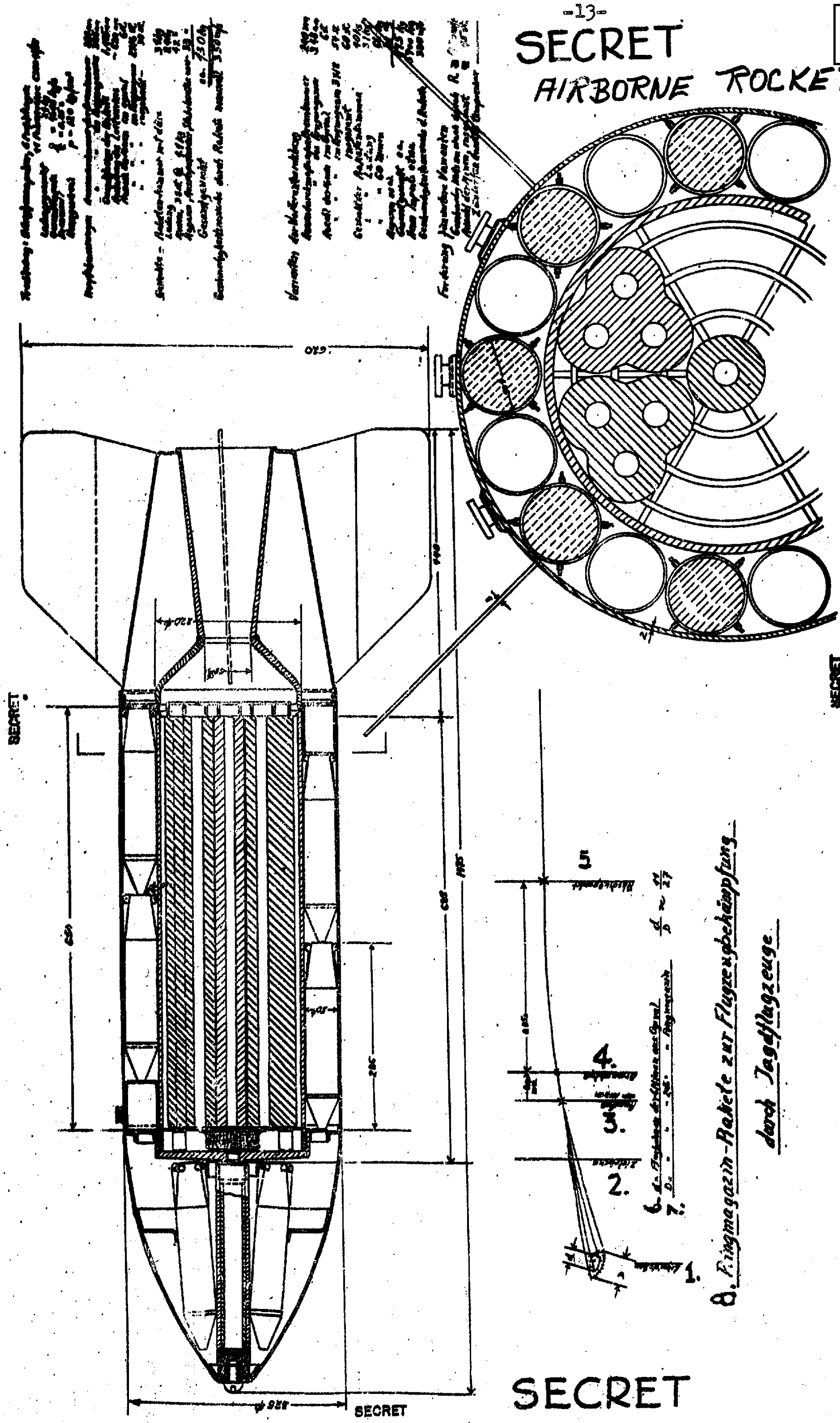
AIRBORNE ROCKET



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Legend to page 13

Translation of Parts

1. Liquidation
2. Target Level
3. Ejection of Projectiles
4. End of Combustion
5. Launching Point
6. Flight Path of 6 Projectiles from Ogive
7. Flight Path of 2x16 from Ring Magazine
8. Ring Magazine Rocket for Bomber Formations from Fighter Planes

Information Pertinent to the Design

Propelling Charge – Nitroglycerine Powder, 6 Profile Sticks + 1 Powder Tube 630x48/16

Weight of Powder Charge	24 kg.
Total Impulse	g 4600 kg./sec.
Combustion Period	f 0.65 sec.
Nominal Gas Pressure	p 120 kg./cm.^{2}

Leading Dimensions:

Outside Diameter of Combustion Chamber		220 mm.
Outside Diameter of Ring Magazine		325 mm.
Total Length of Rocket		1475 mm.
Expansion of Tail Assembly		620 mm.
Number of Projectiles in Ogive		6 pieces
Number of projectiles in Ring Magazine	2x16	32 pieces
	Total	38 pieces

Weights – Rocket Chamber with Jet Approximately	31 kg.
Charge	24 kg.
Projectiles, 38 Pieces at Approximately 1.1 kg. each	42 kg.
Magazine, Ejection Cylinder, Stabilizer, etc.	33 kg.
Total Weight, Approximately	130 kg.

Acceleration of Speed by Rocket, Nominally 350 m./sec.

Variations of Succeeding Developments

Outside Diameter of Combustion Chamber		240 mm.
Outside Diameter of Ring Magazine		348 mm.
Number of Projectiles in Ogive		6 pieces
Number of Projectiles in Ring Magazine	3x18	54 pieces
	Total	60 pieces

Weight of Rocket Chamber	40 kg.
Weight of Charge	31 kg.
Weight of the 60 Projectiles	66 kg.
Magazine, etc.	38 kg.
	175 kg.

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Legend to page 13 (continued)

Nominal Impusle Approximately	5900 kg./sec.
Acceleration of Speed of Rocket	330 m./sec.

Requirements for Further Variations

Acceleration of Speed Through Rocket	450 m./sec.
Total Number of Projectiles	45 pieces

Igniter for Ejection - Adjustable

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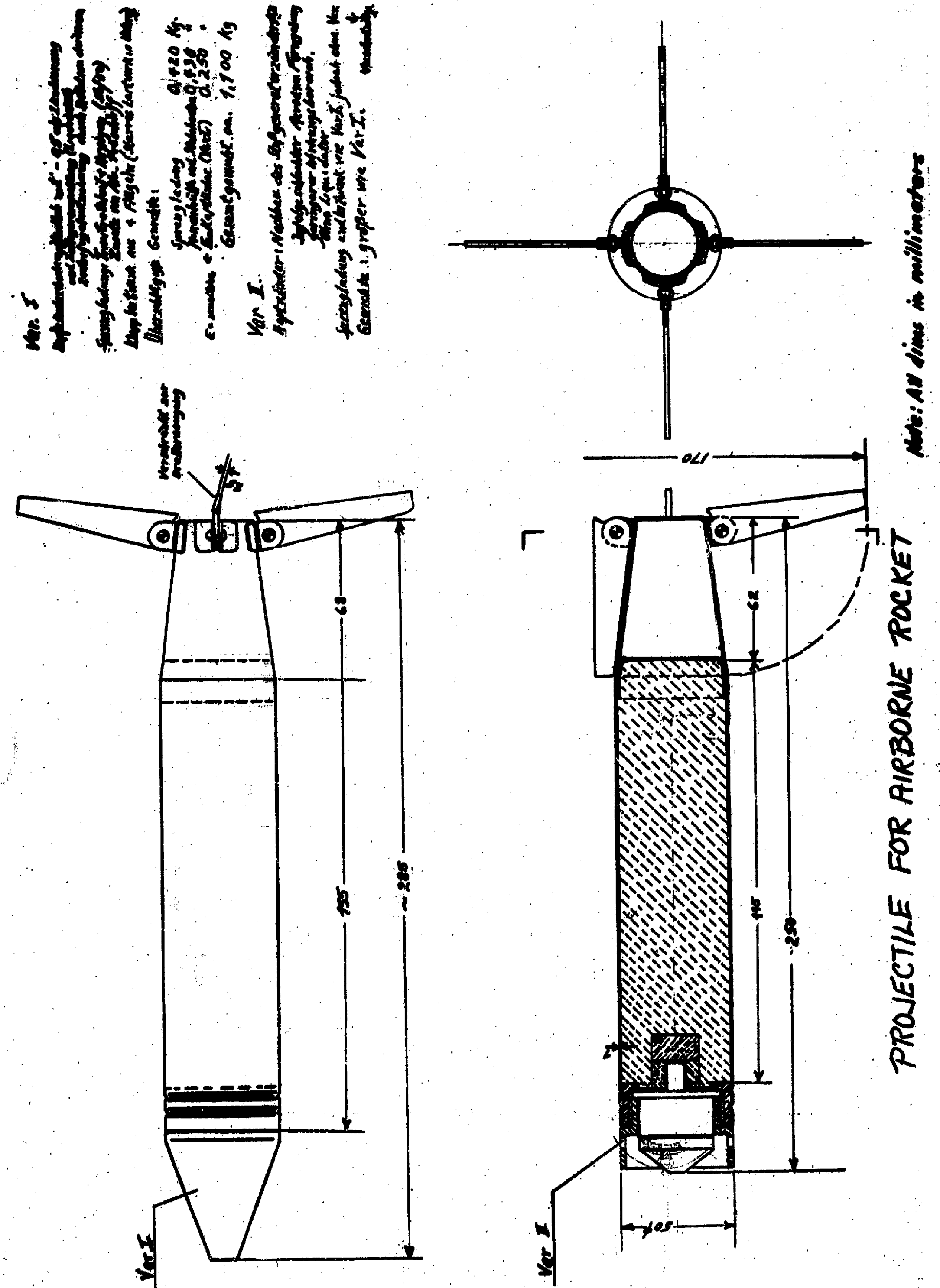

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Legend to page 16

Translation Projectile for Airborne Rocket

Variation I

Nose Fuse: highly sensitive with 0.5 m./sec. ignition lag and disintegrating device (liquidator) Centrifugally armed by rotation of projectiles

Explosive Charge: TRINITROTOLUENE + TETRAMETHYLENETRI-NITRAMINE (50/50) Addition of Aluminum "Pyroschliff"

Folding Tail Assembly of 4 Wings (Stiff Tail Assembly in Trial)

Estimated Weights:

Explosive	0.420 kg.
Projectile Housing and Stabilizer	0.430 kg.
E. Nose Fuse (Var. I)	0.250 kg.
Total Weight Approx.	1.100 kg.

Variation II

Nose Fuse: Reconstruction of Impact Generator Fuse (66) Due to bad aerodynamic shaping, lowering of range of effectiveness Without Liquidator

Explosive Charge and Tail Assembly same as Var. I but without crossing

Weights: Greater than Var. I